

REMARKS

Claims 2-8, 15 and 18-27 are pending in the present application. Claims 2-8, 15 and 18-27 have been amended. Claims 4-6, 19-22 and 24-26 have been withdrawn from consideration as non-elected.

Claim Rejections-35 U.S.C. 103

Claims 2, 3, 7, 8, 15, 18, 23 and 27 have been rejected under 35 U.S.C. 103(a) as being unpatentable over the Aoki et al. reference (U.S. Patent No. 6,033,953) in view of the Lu reference (U.S. Patent No. 5,679,596). This rejection, insofar as it may pertain to the presently pending claims, is traversed for the following reasons.

The ferroelectric capacitor of claim 2 includes in combination a stepped bottom electrode "having a plainer base electrode with a plurality of projection electrodes on the planar base electrode"; a ferroelectric layer on the stepped bottom electrode; and a top planar electrode on the ferroelectric layer, "wherein a thickness of the ferroelectric layer on the projection electrodes is less than a thickness of the ferroelectric layer on the planar base electrode, and wherein spacing between central portions of each projection electrode has a range from 10% to 20% of a size of the ferroelectric capacitor". Applicant respectfully submits that the ferroelectric capacitor of claim 2 would not have been obvious in view of the prior art as relied upon by the Examiner for at least the following reasons.

The Examiner has asserted that Fig. 14 of the primarily relied upon Aoki et al.

reference discloses all the features of claim 2, except for the featured spacing between projection electrodes. In an effort to overcome this acknowledged deficiency of the primarily relied upon Aoki et al. reference, the Examiner has asserted that the spacing of electrodes as featured in claim 4 would have been obvious in view of the secondarily relied upon Lu et al. reference as considered with respect to Fig. 5. Applicant respectfully disagrees for the following reasons.

As described in column 1, lines 50-57 of the Aoki et al. reference with respect to Fig. 14, the surface of platinum bottom electrode 38 manifests a rough surface with many pointed convex parts 38a existing in an island shape. This is due to the fact that particles of platinum adhere in a conical shape from sputtering or vapor deposition. Thus, the structure in Fig. 14 of the Aoki et al. reference does not include a stepped bottom electrode having a planar base electrode with a plurality of projection electrodes on the planar base electrode, as would be necessary to meet the features of claim 2. This rejection is therefore improper for at least these reasons.

With further regard to this rejection, as emphasized previously, platinum bottom electrode 38 in Fig. 14 of the Aoki et al. reference includes many pointed convex parts 38a existing in an island shape. The Examiner has suggested modifying the structure in Fig. 14 of the Aoki et al. reference in view of the Lu reference, to provide spacing between central portions of each pointed convex part 38a in Fig. 14 of the Aoki et al. reference within a range from 10% to 20% a size of the ferroelectric capacitor. Applicant however respectfully submits that even if proper motivation existed for

modifying the structure in Fig. 14 of the Aoki et al. reference in view of Figs. 5-7 of the Lu reference, the combined teaching would not meet the features of claim 1.

In particular, the goal of the Lu reference is to increase capacitance of the structure by increasing surface capacitor area. This is done in Figs. 5-7 of the Lu reference by providing a stepped bottom electrode 11, conformal dielectric layer 15 thereon, and stepped upper electrode 16 disposed in an interlocking, mating configuration with bottom electrode 11. If one of ordinary skill was motivated to modify the structure in Fig. 14 of the Aoki et al. reference to increase capacitance of the structure by increasing surface capacitor area in view of the Lu reference, the structure in Fig. 14 of the Aoki et al. reference as modified would presumably include a conformal dielectric layer on platinum bottom electrode 38 and a platinum upper electrode having pointed convex parts that are in an interlocking, mating configuration with pointed convex parts 38a of platinum bottom electrode 38. The structure in Fig. 14 of the Aoki et al. reference as modified in view of the Lu reference would not include a top planar electrode on a ferroelectric layer, wherein a thickness of the ferroelectric layer on the projection electrodes would be less than a thickness of the ferroelectric layer on a planar base electrode, as would be necessary to meet the features of claim 2. Accordingly, Applicant respectfully submits that the ferroelectric capacitor of claim 2 would not have been obvious in view of the prior art as relied upon by the Examiner taken singularly or together, and that this rejection, insofar as it may pertain to claims 2 and 8, is improper for at least these reasons.

With still further regard to this rejection, Applicant respectfully submits that one of ordinary skill would have no motivation to modify a method of forming a platinum capacitor electrode as by sputtering or vapor deposition as disclosed in the Aoki et al. reference, using a method of forming a polysilicon capacitor electrode having pillars formed by spot deposited polysilicon as disclosed in the Lu reference. That is, different electrode materials and processes are used, and the methods of electrode formation are thus incompatible with each other. It is not clear how convex parts 38a in the Aoki et al. reference could be formed by sputtering or vapor deposition in a controlled manner so as to have specific spacing therebetween as suggested by the Examiner. The Examiner has failed to explain or establish how convex parts 38a of the Aoki et al. reference could be formed to have specific spacing therebetween so as to meet the features of claim 2. Applicant therefore respectfully submits that the ferroelectric capacitor of claim 2 would not have been obvious in view of the prior art as relied upon by the Examiner taken singularly or together, and that this rejection, insofar as it may pertain to claims 2 and 8, is improper for at least these additional reasons.

If this rejection is to be maintained, the Examiner is respectfully requested to explain how the presumably randomly positioned pointed convex parts 38a formed due to particles of platinum adhering in conical shape from sputtering or vapor deposition as shown in Fig. 14 of the Aoki et al. reference, could be formed in view of the Lu reference as having spacing therebetween within a range of 10% to 20% of a size of the ferroelectric capacitor.

The ferroelectric capacitor of claim 3 includes in combination a stepped bottom electrode "having a planar base electrode with a plurality of projection electrodes on the planar base electrode"; a ferroelectric layer on the stepped bottom electrode; and a top planar electrode on the ferroelectric layer, "wherein a thickness of the ferroelectric layer on the projection electrodes is less than a thickness of the ferroelectric layer on the planar base electrode, and wherein a size of each projection electrode has a range from 5% to 10% of a size of the ferroelectric capacitor".

As emphasized previously, the structure in Fig. 14 of the primarily relied upon Aoki et al. reference includes platinum bottom electrode 38 that has a rough surface with pointed convex parts 38a existing in an island shape. The structure in Fig. 14 of the Aoki et al. reference does not include a stepped bottom electrode. Moreover, even if motivation existed for modifying the structure in Fig. 14 of the Aoki et al. reference in view of the secondarily relied upon Lu reference as suggested by the Examiner, the modified structure would presumably include a conformal dielectric layer on platinum bottom electrode 38, and an upper electrode having pointed convex parts disposed in an interlocking, mating configuration with pointed convex parts 38a of platinum bottom electrode 38. The modified structure would not include a top planar electrode as would be necessary to meet the features of claim 3. Also, the method of forming a polysilicon capacitor electrode having pillars formed by spot deposited polysilicon in the Lu reference would not be compatible with the method of forming a platinum capacitor electrode as by sputtering or vapor deposition as in the Aoki et al. reference. It is not

clear how seemingly randomly formed pointed convex parts 38a in Fig. 14 of the Aoki et al. reference could be formed so as to have a size within a range from 5% to 10% of a size of the ferroelectric capacitor. Accordingly, Applicant respectfully submits that the ferroelectric capacitor of claim 3 would not have been obvious in view of the prior art as relied upon by the Examiner taken singularly or together, and that this rejection, insofar as it may pertain to claims 3 and 23, is improper for at least these reasons.

The ferroelectric capacitor of claim 7 includes in combination a stepped bottom electrode "having a planar base electrode with a plurality of projection electrodes on the planar base electrode"; a ferroelectric layer on the stepped bottom electrode; and a top planar electrode on the ferroelectric layer, "wherein the projection electrodes are arranged spaced apart from each other evenly, and wherein a thickness of the ferroelectric layer on the projection electrodes is less than a thickness of the ferroelectric layer on the planar base electrode, and cores of polarization inversion within the ferroelectric layer extend from the projection electrodes".

Applicant respectfully submits that the ferroelectric capacitor of claim 7 would not have been obvious in view of the prior art as relied upon by the Examiner for at least somewhat similar reasons as set forth above. Moreover, it is not understood how the seemingly randomly located pointed convex parts 38a existing in island shape that adhere in a conical shape from sputtering or vapor deposition as shown in Fig. 14 of the Aoki et al. reference could be modified so as to be arranged spaced apart from each other evenly, particularly in view of the Lu reference, as would be necessary to meet the

features of claim 7. Additionally, it is not clear that cores of polarization inversion within dielectric layer 40 in Fig. 14 of the Aoki et al. reference as modified in view of the Lu reference as suggested by the Examiner, would extend from pointed convex parts 38a. Cores of polarization inversion are not particularly described with respect to Fig. 14 of the Aoki et al. reference. Accordingly, Applicant respectfully submits that the ferroelectric capacitor of claim 7 would not have been obvious in view of the prior art as relied upon by the Examiner taken singularly or together, and that this rejection, insofar as it may pertain to claims 7 and 27, is improper for at least these reasons.

The ferroelectric capacitor of claim 15 includes in combination among other features a first stepped electrode "comprising a first planar electrode having a plurality of projection electrodes on the first planar electrode and spaced apart from each other evenly"; a second planar electrode; and a ferroelectric layer "sandwiched between the first stepped electrode and the second planar electrode, wherein a thickness of the ferroelectric layer on the projection electrodes is less than a thickness of the ferroelectric layer on the second planar electrode, and cores of polarization inversion within the ferroelectric layer extend from the projection electrodes".

Applicant respectfully submits that the structure in Fig. 14 of the Aoki et al. reference does not include a first stepped electrode as would be necessary to meet the features of claim 15. Moreover, even if motivation existed for modifying the structure in Fig. 14 of the Aoki et al. reference in view of the Lu reference as suggested by the Examiner, the structure in Fig. 14 of the Aoki et al. reference as modified would

presumably include a conformal dielectric layer on platinum bottom electrode 38 and an upper electrode having pointed convex parts disposed in an interlocking, mating configuration with pointed convex parts 38a of platinum bottom electrode 38. The modified structure would not include a second planar electrode as featured in claim 15.

Moreover, the method of forming a polysilicon capacitor electrode having pillars as by spot deposited polysilicon as disclosed in the Lu reference would be incompatible with the method of forming a platinum capacitor electrode as by sputtering or vapor deposition as shown in the Aoki et al. reference. It is not clear how pointed convex parts 38a in the modified structure of Fig. 14 of the Aoki et al. reference could be formed as spaced apart from each other evenly. Moreover, there is no disclosure or suggestion that cores of polarization inversion within dielectric layer 40 in Fig. 14 of the Aoki et al. reference as modified in view of the Lu reference would extend from pointed convex parts 38a. Accordingly, Applicant respectfully submits that the ferroelectric capacitor of claim 15 would not have been obvious in view of the prior art as relied upon by the Examiner taken singularly or together, and that this rejection, insofar as it may pertain to claims 15 and 19, is improper for at least these reasons.

Conclusion

The Examiner is respectfully requested to reconsider and withdraw the corresponding rejection, and to acknowledge that claims 2, 3, 7, 8, 15, 18, 23 and 27 are allowable, for at least the above reasons. The Examiner is also respectfully

requested to rejoin claims 4-6, 19-22 and 24-26, which as dependent upon the above noted claims, should be allowable for at least the same reasons as set forth above.

In the event that there are any outstanding matters remaining in the present application, please contact Andrew J. Telesz, Jr. (Reg. No. 33,581) at (571) 283-0720 in the Washington, D.C. area, to discuss these matters.

Pursuant to the provisions of 37 C.F.R. 1.17 and 1.136(a), the Applicant hereby petitions for an extension of two (2) months to April 29, 2008, for the period in which to file a response to the outstanding Office Action. The required fee of \$460.00 should be charged to Deposit Account No. 50-0238.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment for any additional fees that may be required, or credit any overpayment, to Deposit Account No. 50-0238.

Respectfully submitted,

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